



The Application of Organic Plant Media Composition on Green Mustard Crops (*Brassica Juncea* L) in Polybag

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ABSTRACT

Green mustard plants are the main vegetable crops consumed by urban communities. The need for this vegetable increases along with the increase in culinary tourism in each region and the government's appeal on sustainable food home. One effort made to meet the needs of vegetable mustard in urban areas can be cultivated using polybags. The main problem of vegetable cultivation on polybags is the availability of soil media. To overcome the limitations of soil media it is attempted to substitute it with organic litter enriched with LOM (local microorganisms). The purpose of research is to find the right combination of planting media for mustard plants. The results showed that the composition of K7 = soil: compost: litter of hay: litter of maize (2: 1: 1: 1) best on plant length, number of leaves, length of root leaves and number of roots while the wet weight of mustard plant (g) K7 = soil: compost: litter of maize: litter of corn (2: 1: 1: 1) and K8 = soil: compost: litter of maize: litter of maize: cocopeat (2: 1: 1: 1: 1) or soil: compost + urea. Increased weights of wet mustard by 63% compared to soil media and 20% compared to soil composition: compost + urea. Organic straw in the form of straw: litter of corn stalk: cocopeat enriched with LOM are able to become ready-made planting media on the cultivation of indian mustard plants in polybags

I. INTRODUCTION

1.1. Background

Vegetable cultivation in urban areas is important in order to support national food security and nutritional needs of the community. Green mustard (*Brassica juncea* L.) is a vegetable plant as a source of carbohydrates, vegetable protein, vitamins, and minerals of high economic value. According to data from the Directorate General of Horticulture Ministry of Agriculture (2013), production of green mustard from 2008 to 2011 has increased. However, in 2012 decreased. In 2008 the production reached 65,636 tons, in 2009 amounted to 562,838 tons, in 2010 amounted to 583,770 tons, in 2011 amounted to 580,969 tons and in 2012

decreased by 529,518 tons. In 2008 the production reached 65,636 tons, in 2009 amounted to 562,838 tons, in 2010 amounted to 583,770 tons, in 2011 amounted to 580,969 tons and in 2012 decreased by 529,518 tons. Urban farming is an agricultural activity within or around the city that involves skills, expertise and innovation in cultivation and food processing. Urban farming is an agricultural activity within or around the city that involves skills, expertise, and innovation in cultivation and food processing. The main thing that led to the emergence of this activity is an effort to contribute to food security, increasing the income of the surrounding community as well as recreational and hobby (Enciety, 2011).

It seems that there is no research on the provision of ready-mixed planting media in urban areas. This research was conducted in an effort to exploit organic litter (straw, corn stalk and cocopeat) enriched with local microorganism

(LOM) as substitution of planting medium of green mustard in polybags.

1.2. Literature Review

The use of organic litter such as compost, straw, maize leaf, cocopeat as planting media is an alternative solution to overcome the limitations of urban soil media. Compost made from rice straw and enriched with animal manure will be able to support organic food production in India (Das, Baiswar, Patel, Munda, Ghosh, Ngachan, Panwar and Chandra (2010). Composting of straw has been done by mixing the manure (Li, Zhang., and Pang 2008); mud waste water (Perez., Martinez., Marcilla, and Boluda 2009); pulp of fruit juice (pomace) with rabbit feces (Canet., Pomares, Cabot, Chaves, Ferrer, Ribo, and Albiach, 2008). The macro nutrient of corn litter contain organic C 15.91%, N 0.67%; P 1.05%; K 1.18% (Bambang, Andareas, Nasriati, and Kiswanto, 2010). Plant with planting media on the composition of soil media: compost: paper (2: 1: 1), able to increase the number of leaves by 25%, plant length of 18.23% and wet weight of mustard plant by 40.31%, root length 26.63% and number of roots 17.32% compared with the use of soil cropping medium (Augustien and Suhardjono, 2016). Media cocopeat and charcoal husk (1: 1) in hydroponic green mustard plants, resulting in the addition of leaf length, leaf width, root length and highest wet weight (Risnawati, 2016).

Three types of compost ie peat, wheat straw, and wheat lucerne which was watered continuously for 6 months, carbon leaching from leachate contributed 1.4% of total C, while respiration accounted for 10.4%. Ultisols with sandy textures lose more C than leachate than Oxisol with higher clay content, for simulated tropical rainfall. (Fadly Hairannoor Yusran, 2010). Empowerment of 5 tons / ha + 5 ton / ha LCC (*Colopogonium mucunoides*) empty fruit bunches (EFB) has an effect on the maximum number of tillers and dry weight of grain / m². The resulting dry weight is 17.13g / m² (Panjaitan, 2013). Application of biocompos stimulator *Trichoderma spp.* doses of 15 tons / ha gave the best growth and yield compared to other biocompos doses (Apzani., Sudantha, Fauzi, 2015).

The application of tithonia of 2.5 Mg ha⁻¹ + 75% recommended Urea (150 kg Urea), without synthetic P and K fertilizers seems to be the best treatment to obtain the highest yield (8.08 mg Dry Harvest (HDS) ha⁻¹ (= 7.05 mg Dry Milled Dry Seed (MDS) ha⁻¹) rice, followed by treatment based on farmer's input with 7.25 Mg HDS ha⁻¹ (= 6.41 Mg MDS ha⁻¹) fresh as much as 2.5 Mg ha⁻¹ based on dry weight can be considered as alternative fertilizer for rice crops in intensification fields (Gusnidar, Yasin, Burbey, Yulnafatmawita, Saleh and Andhika, 2012).

The application of 15 Mg ha⁻¹ of bottom ash gives the best effect on plant height, number of leaves, number of tillers and shoot / root ratio, while 10, 15 and 20 Mg ha⁻¹ applications increase the number of productive tillers, the number of grains full, and heavy grain. Bokashi bottom ash does not affect the heavy metal content of upland rice from Situbagendit varieties. (Nunung and Nurkhalidah, 2012)

The results show that OFTP (*Tithonia* plus organic fertilizer) increases the availability of nutrients such as N, P, and K in NPF and controls iron toxicity. The appropriate OFTP formulation for controlling iron toxicity and reducing the application of chemical fertilizers for higher rice production in NPF are two options: (1) 2 Mg *Tithonia* ha⁻¹ + 5 Mg rice straw ha⁻¹ + 50% of commercial fertilizer; and (2) 2 Mg *Tithonia* ha⁻¹ + 75% commercial fertilizer. In this case, the reduction of commercial fertilizer application is 50% and 25% respectively (Hakim, Agustian and Yanti, 2012). FOM generally increases SOM content, percent aggregation, and SAS from Ultisol. Among the sources of organic matter (OM), tithonia provides the highest SOM content after 3 months incubation. The smallest OM size applied shows the highest SOM content. Tithonia with a size of 0.5 cm gave the highest SOM (3.47%) of Ultisol and SAS (Stability Aggregate Soil) increased 68% compared to the initial soil (Yulnafatmawita, Adrinal, and Anggriani, 2013)

1.3. Problem Design

Planting media is one factor that must be considered in a process of planting a plant. Planting media should be able to keep the area around the roots moisture, provide enough air, and can withstand the availability of nutrients, so as to supply nutrients needed by plants.

One model of the cultivation of mustard plants in urban areas is the use of polybag as a container of planting media. The limitation of soil media becomes a major problem in urban agriculture. The use of organic litter such as compost, straw, maize leaf, cocopeat as planting medium is an alternative solution to overcome the limitations of urban soil media.

According to Hapsah, Gusmawartati and Yusuf (2015), the compost contain 0.77 to 1.19% nitrogen, 0.23 to 0.30% phosphorus, 0.46 to 0.69% potassium and 15.48 to 34.69% organic matter. The combination of agricultural waste and municipal waste affects the quality of compost. Compost that meets SNI 19-7030-2004 is a combination of rice straw + market waste containing nitrogen 1.12%, 0.28% phosphorus, 0.63% potassium, C / N ratio 19.50, pH 7.42, and organic matter 37.65%.

II. METHODOLOGY

The experiment was conducted in experimental garden of Faculty of Agriculture UPN "Veteran" of East Java, at the height of place 4 meters above sea level. Enriching organic litter by making LOM solution. Materials used rotted papaya + rabbit feces + leaf lamtoro + LOMasses + yeast tape. All the ingredients are inserted in a plastic barrel then dissolved in water until submerged, all the ingredients are stirred evenly. Continue in incubation for 14 days. Organic straw in the form of straw, corn stalks and cocopeat each cut into small pieces 2-3 cm (Fig.1). The organic litter enrichment is done by soaking in local microbial solution (LOM) for 20 days. Compost material is made from leaf litter around the campus. Land used land garden. Further treatment is provided by mixing the soil with litter according to the treatment. As an indicator plant used Tosacan varietal seed varieties.

The treatments are as follow: K0: soil, K1: Soil: Compost (2: 1); K2: Soil: Compost + Urea (2: 1); K3: Soil: Compost: Corn stalk (2: 1: 1); K4: Soil: Compost: Straw (2: 1: 1); K5: Soil: Compost: Cocopeat (2: 1: 1); K6: Soil: Compost: Cornstalk Leaf: Cocopeat (2: 1: 1: 1); K7: Land: Compost: Cornstalk Leaves: Straw (2: 1: 1: 1); K8: Soil: Compost: Straw: Cocopeat: Corn Stalk Leaf (2: 1: 1: 1: 1). The design used is a complete randomized design (RAL) with 5 replications so as to obtain 5 polybag unit experiment.

The data is tested by fingerprint variety and then tested the smallest real difference of 5%.

Planting of mustard seed sowing in tray for 3 weeks, then transplanted to polybags that have been provided, one seed / polybag (Fig.2). Plant maintenance were watering and weeding. Variable observation of the length of the plant, the number of leaves, leaf area, wet weight of the plant, root length and the number of roots.



Corn Stalk Leaves



Cocopeat



Straw



MOL



Soaking Litter with MOL



Fig.1. The Ingredients of Planting Media



Brassicca Juncea L. Baby (a)



Brassicca Juncea L. Plant with Composition Media (b)

Fig.2. Green mustad plant before (a) and after transplanted (b)

III RESULT AND DISCUSSION

The results showed that the application of organic plant media composition in green mustard plant (*Brasica Juncea* L) there was a real difference between the treatment of the results of the sustainability test on 5% BNT test is presented in Table 1.

At the age 28 days after transplanting (Table 1), green mustard plant shows the phenotype of the plant has been ready to be harvested. The treatment of plant plant composition contributes different phenotypes to Tosacan varieties. In the process of stem lengthening the stems indicate that the composition of plant medium K7 = Soil: Compost: Corn Bread Leaves: Straw (2: 1: 1: 1) highest reach 42.20 cm, but not significantly different with K2 = Soil: Compost + Urea (2: 1) reaches 41.60 cm and K3 = Soil: Compost: Corn stalk (2: 1: 1) reaches 40.20 cm, compared with other treatments. Treatment of K7 without urea fertilizer is able to achieve the highest planting length of the mustard which means that enrichment process occurred in straw litter. The maize stem with LOM provide adequate supply of nutrients for stem extension of mustard plant.

TABLE 1. THE LENGTH (CM), THE NUMBER OF LEAF (PC) AND THE AREA OF LEAF (CM²) OF GREEN MUSTARD AT 28 DAY AFTER TRANSPLANTING

Treatment	The length (cm)	Number of leaf (pc)	Leaf area (cm ²)
K0	36.70 a	8.80 a	152.25 a
K1	35.40 a	11.40 b	180.60 ab
K2	41.60 bc	11.40 b	145.85 a
K3	40.20 bc	11.80 b	219.75 bc
K4	38.20 ab	10.60 ab	173.70 a
K5	38.50 ab	11.20 b	209.50 ab
K6	39.30 b	10.80 ab	220.60 c
K7	42.20c	12.00 b	243.45 c
K8	38.60 ab	10.80 ab	211.60 bc
BNT 5%	2.61	2.13	53.36

Note: Figures in columns and accompanied by the same letters mean not differing on the 5% BNT test

The composition of planting medium showed no significant difference in the number of leaves. The highest number of leaves reached 12 strands in K7 = Soil: Compost: Corn Bread Leaves: Straw (2: 1: 1: 1) not significantly different from K1, K2, K3, K4, K5, K6 and K8, but K4, K6 and K8 is not significantly different from K0 = soil, lowest number of leaves is 8,80 strands. In the leaf area of the highest planting composition reached 243.45 cm² at K7 = Soil: Compost: Corn Bread Leaves: Straw (2: 1: 1: 1) not significantly different from K3, K6 and K8. The lowest leaf area at K0 = land reaches 152.25 cm² but not significantly different with K1, K2, K4 and K5. Actual phenotypes of mustard plants with plant medium K7 = Soil: Compost: Corn Bread Leaves: Straw (2: 1: 1: 1) contributes more optimal growth than plant medium K0 = soil, K1: soil: compost or

K2 = Compost + urea. Planting of mustard greens in polybags with K7 plant medium were able to increase the plant length, leaf number and leaf area by 13%, 26% and 37% respectively compared to K0 = soil.

The habit of planting mustard in polybags using planting medium K2 = soil: compost + urea, then when compared with K7 contribution to plant length, leaf number and leaf area is still better K7. The use of K7 planting medium increased the length of the plant, the number of leaves and leaf area respectively by 1.4%, 5% and 40% compared to K2 = Soil: Compost + Urea. The use of K7 planting media for mustard plants produces broader and healthier leaves because it does not use chemical fertilizers. The straw litter enrichment process, corn stalks during the 14-day incubation period is the process of destroying organic matter, and there is a great reduction in the bacteria of Mesophilia due to the drastic increase in temperature. It is also accompanied by the emergence of thermophilic flora, such as fungi and ctnymicetes. Thermophilic flora usually appear within 5-10 days after the decomposition process. At the end of the process of decomposition of bacteria Mesophilia is no longer found and the full role to decompose organic materials replaced by thermophilic flora, then the decomposition process will run very slowly characterized by changes in complex organic substances into colloidal fluid with iron, calcium, and nitrogen content eventually became fertilizer (Palar, 2009).

Carbohydrates contained in organic litter and LOMase will undergo a process of hydrolysis by cellulotic microbes with the help of cellulase enzymes that can convert cellulose. It is further hydrolyzed to D-glucose and ultimately fermented so as to absorb lactate, ethanol, CO₂, and H₂O. then amylolytic microbes will produce amylase benzylase which is responsible for converting carbohydrates into glucose (Yulianingsih, 2006). In addition there is a reshuffle of proteins in the organic acid to amino acids (aminization) which then becomes ammonia gas resulting in the emergence of aroma of rot. This ammonia gas will react with water and turn into ammonium (NH₄⁺) which is easily available for microbes and plants (amonification process). If conditions are favorable then nitrification process may occur. This nitrification passes through two stages, nitrites that convert ammonium (NH₄⁺) to nitrite (NO₂⁻) by *Nitrosomonas* sp bacteria, then nitrate which converts nitrite to nitrate (NO₃⁻) by *Nitrobacter* bacteria which is a form available for plants that also benefit the plant (Rosmarkan and Yuwono, 2003).

Table 2 indicates that the treatment of plant composition significantly different at 5% BNT level. The root length variables appear on the composition K7 = soil: compost: straw: the corn stalk (2: 1: 1: 1) reaches 39.10 cm longest, but not significantly different from K6 = Soil: Compost: Corn Leaf: Cocopeat (2: 1: 1: 1) reaches 36.70 cm and K8 = Soil: Compost: Straw: Corn Leaf: Cocopeat (2: 1: 1: 1) reaches 34.60 cm compared to K0 = ground, root length only reaches 19 , 20 cm and K2 = soil: compost + long root urea reach only 24.60 cm. Similarly, the amount of the root of the mustard, the composition of K7 = soil: compost: straw: the

leaves of corn stalk (2: 1: 1: 1) is the best planting media composition than K0 = soil, and K2 = soil: compost + urea. The composition of planting media K7, K6 and K8 became the ideal composition for the growth of mustard plants especially on root extension, as well as K7 appears to reach the largest number of roots. This is due to the physical condition of planting media support for the development of rooting of mustard plants. The use of organic litter enriched with LOM increases the number of microorganisms. In addition, increasing the microbial population in the soil (Jayakumar and Sakthivel, 2012). Increased microbial populations (both species and amount) lead to increased mineralization of soil organic matter and nutrient availability for plants (Arancon, Edwards and Bierman.2006).

TABEL 2. THE LENGTH OF ROOT (CM), NUMBER OF ROOT, FRESH WEIGHT OF PLANT (G) OF GREEN MUSTARD AT 28 DAYS AFTER TRANSPLANTING

Treatment	The length of root (cm)	Number of root	Fresh weight (g)
K0	19.20 a	9.40 a	126.80 a
K1	23.40 ab	13.00 b	293.80 c
K2	24.60 b	16.20 c	276.40 c
K3	20.20 a	10.20 a	222.40 b
K4	23.20 ab	14.00 bc	289.00 c
K5	29.00 c	14.00 bc	289.40 c
K6	36.70 d	12.60 b	296.60 c
K7	39.10 d	23.00 d	346.00 d
K8	34.60 d	14.60 bc	346.00 d
BNT 5%	4.19	3.02	53.57

Note: Figures in columns and accompanied by the same letters mean not differing on the 5% BNT test

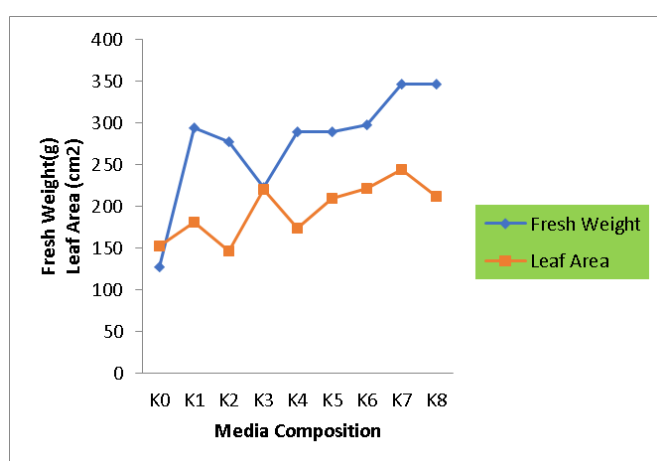


Fig. 3. Fresh weight and Leaf area of green mustard in various composition of planting media

Fresh weight of the mustard plant (Table 3) highest in K7 did not differ significantly with K8, this was supported by the long variable of plant, the highest number of leaves and leaf area compared with K0 and K2 (Table 1). Wet weight of mustard plant with plant medium K7 = soil: compost: straw: corn stalk (2: 1: 1: 1) reaches 346 g / plant no different with

K8 = soil: compost: straw: corn stalk: cocopeat (2: 1: 1: 1: 1). Provision of suitable organic material into the soil can help the activity of microorganisms in remodel the organic material of nitrogen source, so the soil becomes loose, and increase the availability of nitrogen nutrients. Nyakpa *et.al* (1988) states that organic material also releases N and other compounds after decomposition by soil microorganism activity. Gardner, Pearce, and Mithcel (1991) stated that nutrients will be used to stimulate the process of photosynthesis. The results of photosynthesis will be translated throughout the plant to spur vegetative and generative growth of the plant. The more leaves that are formed followed by the optimal leaf area, the process of photosynthesis is optimal. The result of photosynthesis will be transacted on leaf and leaf organ so that the addition of plant height, moist media planting friable and crumbs support growth of rooting so that the absorption of roots to the availability of nutrient media become more optimal.

The physical condition of each planting medium is presented in Table 3. The differences in plant cultivation composition on the results of leaf area and wet weight of plants significantly affect the wet weight and leaf area of mustard plant (Fig.4). The composition of K7 and K8 is superior to wet weight varieties of mustard plants, and K7 composition is more optimal for leaf area.

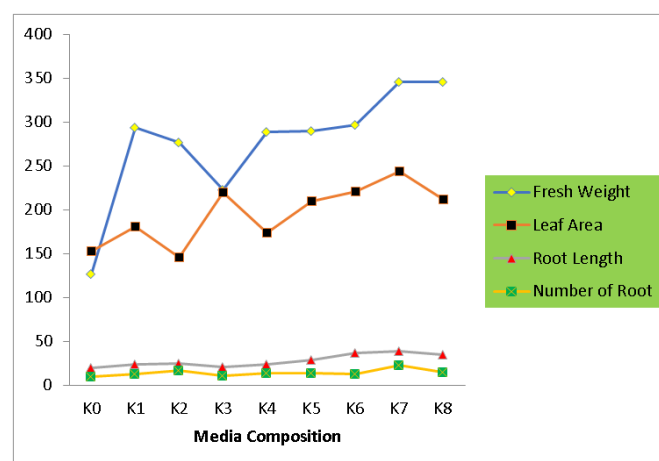


Figure 4. Graph of Number of Roots, Roots Length, Leaf Area and Fresh Weight *Brassica Juncea* L. on Media Composition

Physically K7 = soil: compost: straw: corn stalk (2: 1: 1: 1) with BJ 2.22 and BI 1.15, R Pore 48.18 and KAKL = water content Field capacity 42.37 in Table 3 shows the planting medium more friable, crumbs and moisture. The soil pore space is the part occupied by air and water. The amount of pore space is partially determined by the arrangement of solid grains, when the location is tighter, as in the sand or solid subsoil, the total porosity is low. While arranged in aggregate clumps as is often the case with large medium-textured soils the pore volume will be high (Buckman and Brady, 1984).

The fine textured soil will have a higher total pore percentage than the coarse texture, although the pore size of the fine textured soil is mostly very small and the porosity

does not show any distribution the pore size in the soil is an important property (Sarief, 1986). The fine textured layer masses are usually between 1.0-1.3 g/cm³. If the soil structure is rough then the mass density is 1.3-1.8 g / cm³. Where the more dense the soil the higher the density of the mass or bulk density so that more difficult to continue the water or penetrated by the roots of plants. The application of organic matter to the soil can lower the soil Bulk Density, this is due to the added organic material having a lower density of the type. The higher aggregate stability can decrease the bulk density of the soil, the percentage of the pore space getting rougher and the higher water binding capacity (Kartasapoetra and Sutedjo, 1991).

TABEL 3. DENSITY, PORE SPACE, AND KAKL TREATMENT OF PLANT MEDIA COMPOSITION.

Treatment	BJ (g.cm ³)	BI (g.cm ³)	R. Pore (%)	KAKL (%)
K0	2.25	1.43	36.22	33.89
K1	2.24	1.19	46.76	39.98
K2	2.28	1.38	39.65	41.80
K3	2.29	1.22	46.65	41.49
K4	2.23	1.27	43.04	42.75
K5	2.30	1.32	42.70	42.82
K6	2.21	1.30	40.96	44.44
K7	2.22	1.15	48.18	42.37
K8	2.10	1.16	44.95	42.69

Soil density is closely related to root penetration and crop production. If soil compaction occurs, water and air are difficult to store and their limited availability in soil causes stunted root and water absorption and has low nutrients due to low microorganism activity (Hakim *et al.* 1986). The amount of water stored in the soil associated with the weight of the contents (BI) of the soil and BI is influenced by the amount of organic material in the growing medium.

III. CONCLUSION

The use of organic straw in the form of straw, maize leaf and cocopeat enriched with LOM proved capable as substitution material of planting media in mustard plant (*Brassica juncea* L) in polybag. Application of planting medium with composition K7 = soil: compost: straw: maize stem (2: 1: 1: 1) in mustard plant indicate plant length, number of leaves, root length of root and best root number whereas to wet weight of mustard plant g) composition K7 = soil: compost: straw litter: litter of corn (2: 1: 1: 1) and K8 = soil: compost: litter of maize: litter of maize: cocopeat (2: 1: 1: 1: 1) best compared soil or soil medium: compost + urea. Increased weights of wet mustard by 63% compared to soil media and 20% compared to soil composition: compost + urea.

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